4.2 Confinement Design

Safety Criterion: 4.2 - 1

The facility shall be designed to retain the radioactive and hazardous material through a conservatively designed confinement system for normal operations, anticipated operational occurrences, and accident conditions. The confinement system shall protect the worker and public from undue risk of releases such that the radiological and chemical exposure standards of Safety Criteria 2.0-1 and/or 2.0-2 are not exceeded.

Implementing Codes and Standards:

BNFL-5193-SRD-01, Appendix B Implementing Standard for Defense in Depth
BNFL-5193-SRD-01, Appendix A Implementing Standard for Safety Standards and Requirements Identification
DOE IG Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria, 2.3
DOE Order 420.1 Facility Safety, 4.1.1.2

Regulatory Basis:

DOE/RL-96-0006 4.1.1.4 Defense in Depth-Mitigation

Safety Criterion: 4.2 - 2

Important to Safety liquid and gaseous systems and components, including pressure vessels, tanks, heat exchangers, piping, and valves, shall be designed to retain their hazardous inventory such that the radiological and chemical worker or public exposure standards of Safety Criteria 2.0-1 and/or 2.0-2 are not exceeded.

Implementing Codes and Standards:

ASME B31.3-96 Process Piping
ASME SEC VIII Boiler and Pressure Vessel Codes, Rules for Construction of Pressure Vessels
BNFL-5193-SRD-01, Appendix A Implementing Standard for Safety Standards and Requirements Identification

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Safety Criterion: 4.2 - 3

Codes and standards for Important to Safety vessels and piping should be supplemented by additional measures (such as erosion/corrosion programs and piping in-service inspections) to mitigate conditions arising that could lead to a release of radiological or chemical material that would exceed the worker or public exposure standards of Safety Criteria 2.0-1 and/or 2.0-2.

Implementing Codes and Standards:

BNFL-5193-SRD-01, Appendix A Implementing Standard for Safety Standards and Requirements Identification
BNFL-5193-SRD-01, Appendix X* Reliability, Availability, Maintainability, and Inspectability (RAMI)
Document P001/2 Rules for the Design of Piping Systems
Document V001/2 Rules for the Design of Vessels

~~BNFL-5193-ISP-01 TWRS-P Project Integrated Safety Management Plan~~
~~Section: 1.3.10 Classification of Structures, Systems, and Components~~
~~Section: 3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)~~
~~Section: 3.7.1 Passive Features~~

Regulatory Basis:

DOE/RL-96-0006 4.2.2.4 Proven Engineering Practices/Margins-Codes and Standards

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* Next available appendix

4.4 Electrical and Mechanical Systems

Safety Criterion: 4.4 - 1

A list of electric and mechanical components designated as Important to Safety shall be prepared and maintained. The list shall include:
(1) The performance specifications for normal operation and under conditions existing during and following accidents;
(2) The load, pressure, voltage, frequency, and other characteristics, as appropriate, for which the performance specified can be ensured.

Implementing Codes and Standards:
BNFL-5193-SRD-01, Appendix A, Implementing Standard for Safety Standards and Requirements Identification

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Safety Criterion: 4.4 - 2

Structures, systems, and components Important to Safety shall be designed and qualified to function as intended in the environments associated with the events for which they are intended to respond. The effects of aging on normal and abnormal functioning shall be considered in design and qualification.

Implementing Codes and Standards:
10 CFR 50.49 Environmental qualification of electric equipment important to safety for nuclear power
IEEE 323-83 Qualifying Class 1E Equipment for Nuclear Power Generating Stations

Regulatory Basis:

DOE/RL-96-0006 4.2.2.3 Proven Engineering Practices/Margins-Safety System Design and Qualification

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Safety Criterion: 4.4 - 3

This Criterion has been deleted.

Safety Criterion: 4.4 - 4

Structures, systems, and components Important to Safety shall be designated, designed and constructed to permit appropriate inspection, testing, and maintenance throughout their operating lives to verify their continued acceptability for service with an adequate safety margin.

Systems and components designated as Important to Safety that are located in closed cells where access is not possible during facility operation or scheduled shutdown periods shall be designed and constructed to standards aimed at ensuring their suitability for the entire service life with an adequate safety margin. Alternately, provisions may be made for remote replacement, standby cells, or equipment or other methods capable of ensuring a serviceable facility with adequate safety for the duration of the intended operating life.

Implementing Codes and Standards:
BNFL-5193-SRD-01, Appendix A Implementing Standard for Safety Standards and Requirements Identification
BNFL-5193-SRD-01, Appendix X* Reliability, Availability, Maintainability, and Inspectability (RAMI)
IEEE 338-1987 Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems
IEEE 603-1991 Criteria for Safety Systems for Nuclear Power Generating Stations
~~BNFL-5193-ISP-01 TWRS-P Project Integrated Safety Management Plan~~
~~Section: 3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)~~

* Next available appendix

Regulatory Basis:

DOE/RL-96-0006 4.2.7.1 Reliability, Availability, Maintainability, and Inspectability(RAMI)-Reliability
DOE/RL-96-0006 4.2.7.2 Reliability, Availability, Maintainability, and Inspectability (RAMI)-Availability, Maintainability, and Inspectability

APPENDIX X*

RELIABILITY, AVAILABILITY, MAINTAINABILITY, AND INSPECTABILITY (RAMI)**

* Next available appendix

** This appendix is all new; therefore, no redline/strikeout is used.

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RELIABILITY, AVAILABILITY, MAINTAINABILITY, AND INSPECTABILITY (RAMI)

To ensure that the facility meets operational requirements, it is necessary to address issues associated with reliability, availability, maintainability, and inspectability.

Reliability is used as a measure of the ability of an item or system to complete a task, and it is normally expressed as a probability of failure. Reliability is designed in through the use of appropriate design techniques and control of the mode of operation and the environment. Design techniques to be used vary because they are dependent on the specific item or system and the task to be performed. Their purpose is to optimize reliability by the following:

1) Use of proven materials and components
2) Design simplicity
3) Testability
4) Control of manufacturing standards
5) Control of operational mode (e.g., prevention of misuse and overloads)
6) Control of environment (e.g., protection against corrosion and vibration).

Consistent with the BNFL process for tailoring hazard controls using the potential radiological and chemical consequences of individual events, reliability is assigned to SSCs based upon the importance of the SSC to the prevention or mitigation of accidents. The significance of accident prevention and mitigation is determined by the severity of the accident to workers or the public. To implement this tailoring in a clear, consistent, and defensible manner, BNFL Inc. has developed an Implementing Standard for Safety Standards and Requirements Identification. This Implementing Standard includes a Severity Level ranking system which provides the hazard assessment and control teams with a defined way to categorize the potential severity of those events that can result in radiological or hazardous exposure to the workers or the public. The Implementing Standard provides the means by which the hazard assessment and control teams establish target reliabilities for SSCs.

Availability is a measure of the degree to which an item or system is in an operable condition. It is expressed quantitatively as the ratio of the mean time between failures to the sum of the mean time between failures and the mean time to repair. System availability is calculated to determine the potential for downtime. In this way, systems are identified that contribute to decreased availability. Required availability is achieved by specifying additional systems or increasing reliability of existing systems.

Maintainability is a measure of the ability to restore a failed item or system to an operable condition in a specified time. Maintainability is designed into the facility and processes through use of appropriate design techniques, (e.g., the use of specially designed, remotely removable, and replaceable pumps and valves in process systems, and the placement of active pumps or valves within shielded accessible areas equipped with appropriate decontamination facilities that allow hands-on maintenance activities) and logistic support (e.g., scheduling and procedures). Benefits of these design techniques are that they simplify maintenance operations in high radiation areas and remove high maintenance equipment from high radiation areas. Testability of Safety Design Class systems and components is facilitated by such features as redundancy that allow for a system or component to be removed from service for maintenance or testing without loss of safety protection.

Inspectability is the measure of the ease with which items or systems can be inspected for preventative maintenance or assessment of condition. Inspectability is used to monitor facility items in order to maintain their reliability. Inspectability of facility items can be designed in by the use of shielded access areas (as above, to reduce radiation exposure) for active equipment or the provision of monitoring equipment (e.g., material coupons for determining vessel corrosion rates, and in-cell cameras).

During the design phase, the RPP-WTP Facility and processes are evaluated for reliability, availability, maintainability, and inspectability. BNFL uses a number of validated modeling techniques (computer codes, mathematical modeling, failure modes, and effects analysis) for determining reliability and availability of the facility and processes. These are used to identify those facility and process areas that are sensitive with respect to influencing overall facility and process performance. Optimum reliability is established by the use of appropriate standards and quality control. The determination of maintenance and inspection needs is based on facility and process reliability requirements. It is a mixture of process optimization, provision of appropriate design features to aid preventative and scheduled maintenance and inspection, and the development of maintenance and inspection programs (administrative and procedural controls) whose objectives among other things, are to facilitate these activities. Reliability targets are assigned to SSCs only when a quantitative value has been credited for the reliability of an SSC in safety analysis.